STUDY OF PUMPS AND FANS MARKET IN CHINA

Prepared for

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and

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Project Background

CERF/IIEC is a non-governmental, not-for-profit organization, with headquarters in Washington, DC, established to foster the implementation of energy efficiency in developing countries and countries in transition. CERF/IIEC's mission is to accelerate the global adoption of energy efficiency policies, technologies and practices to enable economic and environmentally sustainable development.

This project, funded by the Lawrence Berkeley National Laboratory and the American Council for an Energy-Efficient Economy, supports the China Motor System Energy Conservation Project initiative by conducting a Study of the Pumps and Fans (Blower) Market in China. China has shown strong interest in the U.S. motor system optimization programs (Motor Challenge and BestPractices). Key components of the Motor Challenge program include information dissemination and support for development of a similar China domestic program.

Pumps and fans (blowers) are the two largest consumers of energy in the industrial sector, accounting for half of the rated capacity of motors produced annually and one third of the energy consumption. The study provides for an assessment of the pump and fan (blower) market.

Project Objective

The objective of the study on the pump and fan market is to provide an overview of the market size, product models and efficiencies, major market segments, and leading manufacturers and distributors of these products. In addition, through meetings with manufacturers, end-users, distributors, and industry associations, the benefits of the China Motor System Energy Conservation Project will be promoted and interest will be solicited in program partnership.

Conclusion

Over the last decade, due to its economic policies supporting reform and openness, China has experienced significant economic growth (as measured by GDP) increasing from US$ 434 billion in 1991 to US$ 1,041.8 billion in 2000, an annual average growth rate of 10.25 percent. This growth trend is forecast to continue at about 7% per year through 2020.

China is currently the second largest energy consumer in the world behind the United States. In 1999, China consumed 37.02 quadrillion (10^{15}) Btu representing about 9.5 percent of world energy consumption while the United States accounted for 24.8 percent. In China, coal was the dominant energy source, and the 1,075 million tons consumed was the highest in the world, accounting for 22.7% of global consumption. China's industrial sector has been the biggest energy consumer, accounting for 70% of national consumption. The transportation sector accounts for less than 10% of energy consumption, unlike other developing countries, such as Thailand, where the transportation sector is the largest energy consumer.

In terms of electricity consumption, China consumed 1,206.3 billion kWh in 2000, with a growth rate of about 8 percent per year during the 1990's. In the industrial sector, motors and motor systems are the biggest electricity consumers. Essentially, motors are used

in both production processes and facility end-use. For example, motor systems are an integral part of material processing, material handling, refrigeration, and compressed air. Pumps and fans are significant components and electricity consumers, generally accounting for about 40% of a motor system electricity use.

Generally, pumps are used in two basic functions, production processes and facility end-uses. Single-stage single-suction clean water pumps, have the biggest sales volume, accounting for 38% of all applications. In 2000, China produced 1,029,747 pump units. Of this amount, 899,619 units were centrifugal pumps (87.4%), used mainly for pumping water as opposed to production process applications. The national sales revenue of pumps was US$537 million. The top ten manufacturers have a market share of US$171 million, representing 32% of the total national sales revenue. The efficiency of the OEM's best selling application, single-stage single-suction clean water pump, compared to the Chinese national standard and average European efficiency level, at the same flow rate, is higher than the Chinese national standard B but less than 30% of them can achieve national standard A. Because of very close efficiency level between standard A and average European level, this means that most OEM products have lower efficiency than European products.

Like pumps, fans and blowers are widely used in both production processes and facility end-uses. Centrifugal fans have the largest market share at 34%, while axial-flow fans account for about a 23% of the market, and mixed flow and propeller fans have a combined market share of about 43%. In terms of fan applications, general application is the largest at about 46%. Fan national sales revenue is about US$364 million. The top ten manufacturers account for 69% of the national sales revenue (about US$251 million). There are 481 fan series covering more than 5,000 models of fan in China. One of the best selling models is 4-72 No.5. It is estimated, based on the number of units sold, to account for 25-50% of all fan models sold. In addition, different vane structures mean different efficiency levels. Model 4-72 No. 5 has a vane with an airfoil structure while model T4-72's has a flat shape. At the same vane diameter, the airfoil structure of model 4-72 performs at a higher efficiency than the flat vane structure of model T4-72. Unlike pumps, there are no special standards for fan efficiency. Testing of efficiency is implemented by calculation of relative parameters. Standards prescribe that the variation between the tested value and the alleged efficiency should be within about 5%.

All pump and fan manufacturers in China can be divided into four levels: High Class, Middle Class-1, Middle Class-2 and Low Class. All manufacturers categorized in the High Class play a major role in the market. Their product qualities are usually more efficient than the other manufacturer products. The Middle Class-2 group of manufacturers is the largest group of both pumps and fan manufacturers. Low Class manufacturers are generally small, with few employees, generally family members. The quality and efficiency of products from the Low Class of manufacturers is generally lower, as are their product prices. Many of their products are sold into the local agricultural market or to local electrical/mechanical companies. This is always a very open and competitive market, situated in combined urban/suburban locations. Further, most of these consumers pay little attention to energy efficiency, thus price is the most important decision factor. This situation has forced some large manufacturers to reconsider their products in the market. Some of them have repositioned their market from domestic to international market. Compared to exporters from other countries, large manufacturers from China have a competitive advantage because of their vast economies of scale, inexpensive labor and land, and China's rapidly improving skilled labor and infrastructure quality. These factors result in products with equally competitive

international efficiency levels but lower prices. Further, low production cost manufacturers also produce low to medium quality products for sales in the China market and have been able to expand their markets to other developing countries, particularly in the South East Asia region. Although many of those countries also produce low to medium quality products, their production costs are more expensive than Chinese production. This results in direct competition between low cost product manufacturers from China and the rest of Asia.

China's entry into the WTO in November 2001 will have both a positive and negative impact to its economy and the rest of the world. Foreign firms will enter the China market and enjoy wider investment opportunities with lower cost factors of production under decreasing tariffs and standardizing non-tariff measures. On the other hand, China will enter world markets as a low cost producer. Chinese manufacturers have to deal with non-tariff barriers that exist in the world trade system, such as human rights and environmental issues. The pump and fan industry is likely to be impacted in several ways as follows:

- Chinese expansion into the world market with higher quality products at lower prices than foreign-funded manufacturers.
- Import of high-end and/or specific purpose products that cannot support a return on investment in locating production facilities in China.
- Increased opportunity for energy-efficient products in China, due to their lower price from increased competition.

However, one of the most significant factors necessary for growth of energy-efficient product opportunities in China is government support and promotion. For example, a government initiative to increase awareness of the need and benefits of energy conservation, availability of energy-efficient products, potential for financial support, and development of national energy policies is needed.

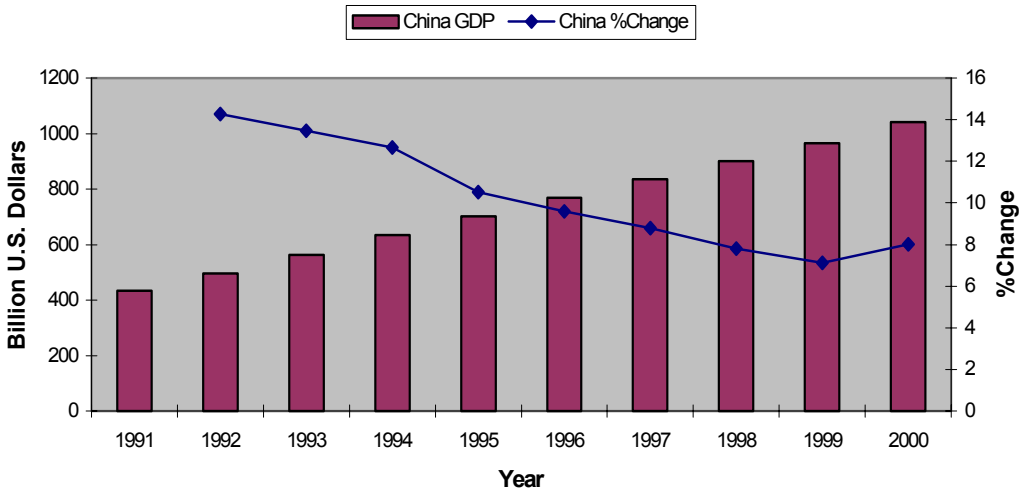
INTRODUCTION

Overview of Economic Situation In China

Over the last decade, due to its economics policies supporting reform and openness, China has experienced significant economic growth in Gross Domestic Product (GDP), increasing from US$434 billion in 1991 to US$1,041.8 billion in 2000, an annual average growth rate of 10.25 percent. These trends are forecast to continue, with growth of about 7% per year through 2020.

The GDP of China comes from three major sectors: agriculture, industry, and service. These sectors contribute about 15, 35, and 50% to GDP, respectively. The industrial sectors will gradually increase their proportion of total output due to the export growth of Chinese low-cost products. This has resulted in growth in demand for energy of 4-5% annually with the parallel development of related environmental issues.

Figure 1: China Gross Domestic Product (GDP) and %Change



*Gross Domestic Product at Market Exchange Rates (Billion of 1995 U.S. Dollars)
Source: Energy Information Administration, International Energy Database, April 2002

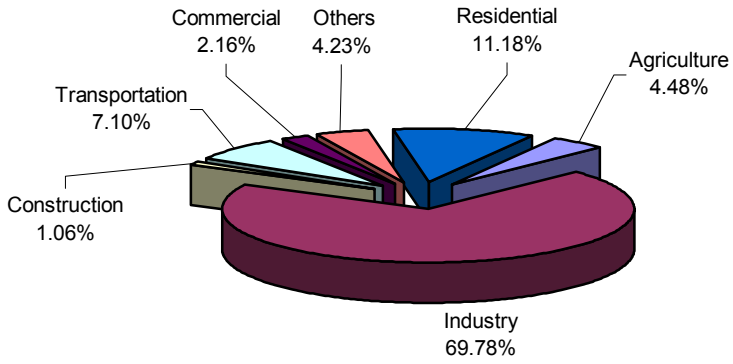
Energy Consumption in China

China is currently the second largest energy consumer in the world behind the United States. In 1999, China consumed 37.02 quadrillion (10^{15}) Btu, or approximately 9.5 percent of world energy consumption, while the United States accounted for 24.8 percent. Coal was the dominant energy source in China, the world highest coal consumption, and accounted for 67.5 percent of total energy production.

Due to new economic reform policies, China has different structure of energy consumption by sector compared to other Asian developing countries.

China's industrial sector has been the biggest energy consumer, accounting for 70% of national consumption. Unlike Thailand and some Asian developing countries, where transportation is the biggest energy consumer, transportation in China accounted for less than 10%, as shown in figure 2.

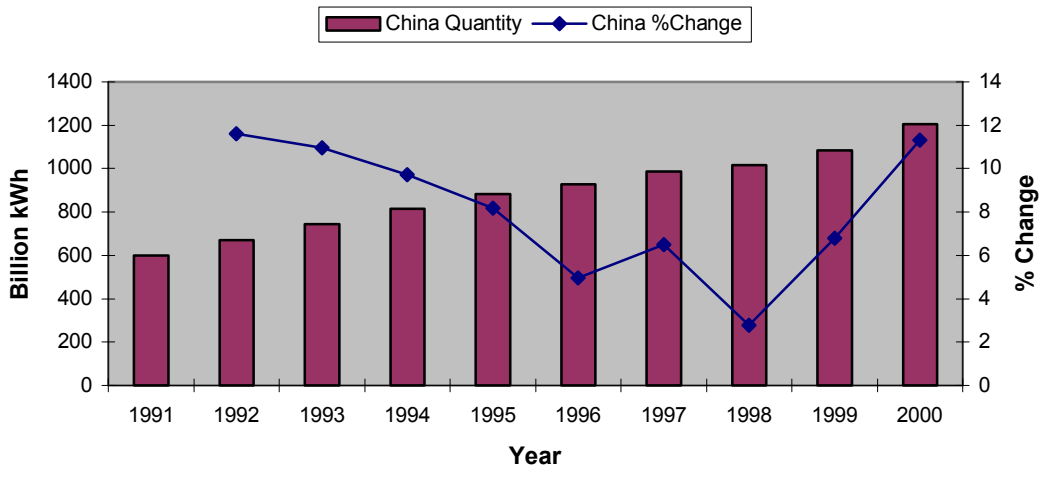
Figure 2: Energy Consumption by Sector (1999)



Source: China Energy Statistical Yearbook 1999

China consumed 1,206.3 billion kWh in 2000, with a growth rate of about 8 percent per year during 1990's. The electricity consumption is forecast to reach 3,349 billion kWh in 2020, which represents average annual percent change of approximately 5.5 %. Robust economic growth in China, especially in the fast growing industrial sector, is the major driver behind the nation's increased electricity demand. Figure 3 illustrates historical data on electricity consumption in China in terms of billions kWh and percentage change.

Figure 3: China Electricity Consumption and % Change

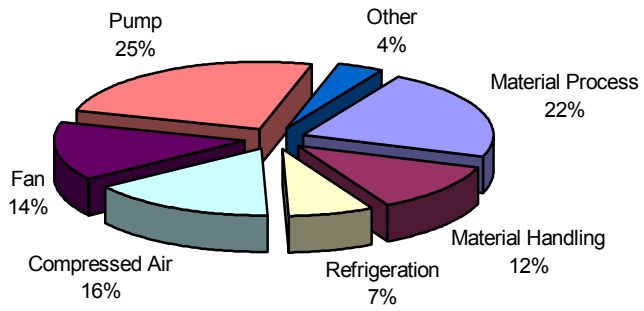


Source: Energy Information Administration, International Energy Annual 2000

One of the biggest electricity consumers in the industrial sector is the motor system, which is critical to both production process and facility end-users. For example, material processing and handling, refrigeration, and compressed air all use motor drives to some extent. Within the motor drive sub-set, pumps and fans are significant electricity consumers and generally account for about 40% of motor system consumption. Consequently, both are prime targets for energy efficiency efforts, such as smart control systems, appropriate applications, replacement of high efficiency equipment, and so forth. Figure 4 shows the study of electricity consumption of fan and pump systems in

the U.S. industries, compared to other motor's applications. It should be noted that, in broad perspective, the proportion of motor end-users of a particular country is not much different from others.

Figure 4: Electricity Consumption of Motor Applications



Source: U.S. Data - Nadel et al. 2002

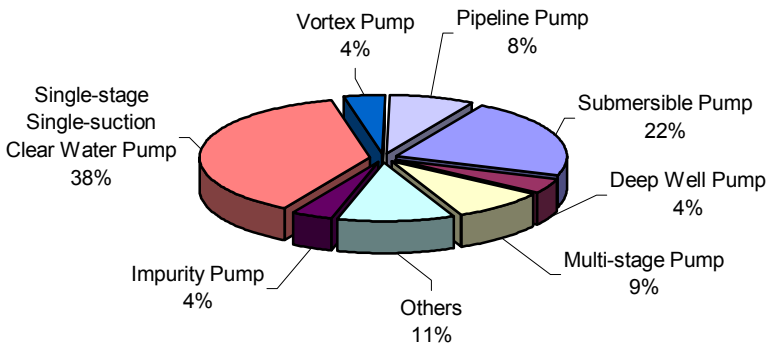
PUMPS AND FANS MARKET IN CHINA

Product Segmentation

Pumps

Generally, pumps are used in two basic functions in the industrial sector: production process and facility end-use. Production process pumps, which are normally integrated in the production machine, supply, transport, mix, and circulate raw materials throughout the process. Facility pumps are used in, for example, circulating chilled water and feeding treated water to boilers. Figure 5 illustrates percentage of sale volume of pump applications. Clearly, single-stage single-suction clean water pump has the biggest sale volume. It is a fundamental application of pumps that are used in both production process and facility end-user.

Figure 5: Pump Applications by Sales Volume



Source: China General Machinery Industrial Yearbook 2002

Several types of pumps are used in the industrial sector, mainly for pumping different fluids at different flow rate, pressure, and total dynamic head. Three most common types of pump are;

1. **Centrifugal Pump:** The major component of a centrifugal pump is an impeller rotating inside a casing. The rotation of the impeller decreases the pump's inlet pressure making fluid flow into the pump. The accelerated fluid then exits the pump propelled by the blades. Centrifugal pumps are used with low viscosity fluids providing a more steady flow that does not work under a high amount of shear. Centrifugal pumps are low cost and low maintenance.

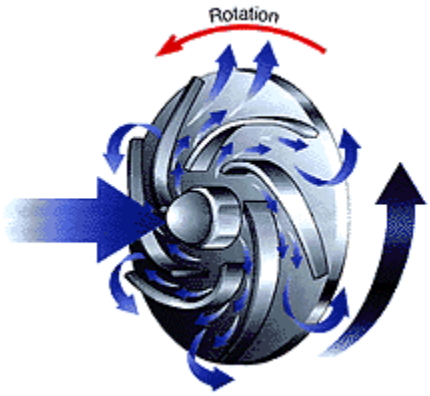


Figure 6: Typical Centrifugal Pump

Source: http://www.kraftunitops.com/pump_centrifugal.html

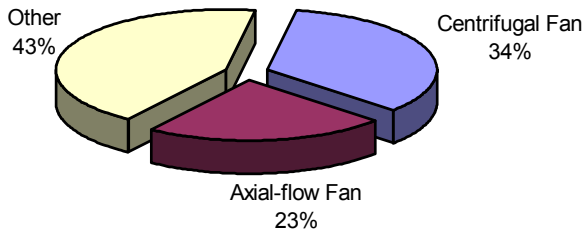
2. **Reciprocating Pump:** Reciprocating pumps are positive displacement pumps. These pumps fill and empty a cavity using pump action propelling the fluid forward. A reciprocating pump consists of pistons and plungers to pump the fluid. In general, reciprocating pumps are suitable to transfer viscous fluids and high-density fluids.

3. **Rotary Pump:** Rotary pump is another type of positive displacement pump and consists of two rotating impellers expanding and collapsing cavity at the pump inlet and outlet, respectively. Fluid flows into the expanding cavity, travels around the impeller, and moves to the outlet of the collapsing cavity. Rotary pumps are used for the same function as reciprocating pumps, but cannot provide steady fluid flows within a limited range of flow rate.

Fans

Like pumps, fans and blowers are widely used in both production process and facility end-uses. Fan and blower use is determined by working pressure requirements. A fan's working pressure is below 34 kPa while a blower's optimal working pressure is higher than 34 kPa. Fans can be classified into four main categories, centrifugal, propeller, mixed flow, and axial-flow. As shown in figure 7, centrifugal fans have the largest market share with 34%, while axial-flow fans account for 23%, and mixed flow and propeller fans account for 43%.

Figure 7: Fan Market Share



Source: China General Machinery Industrial Yearbook 2002

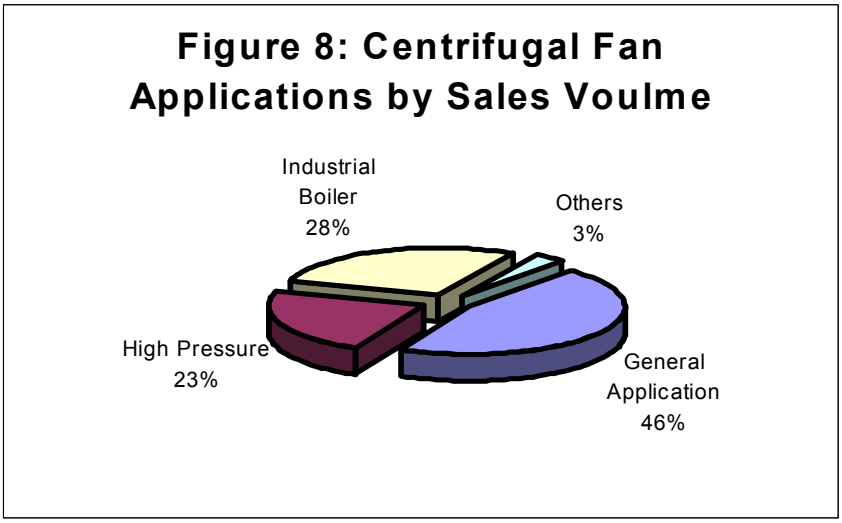
1. **Centrifugal Fan:** A centrifugal fan consists of an impeller with a number of blades rotating in a scroll or spiral shaped casing. The rotation of the impeller pushes air into the volute shaped casing and out through the discharge opening. Simultaneously, the impeller draws air through a central inlet opening, thus causing a continuous flow of air through the fan impeller and casing.

2. **Propeller Fan:** In a propeller fan, a curved sheet metal-bladed impeller is fitted to the motor spindle. The impeller draws air from all directions, and discharges air parallel to the axis of the fan. Its main application is for ventilation.

3. **Mixed-flow Fan:** The mixed-flow fan is a combination of centrifugal and propeller fan. It combines the ability to move large volumes of air of the propeller fan, and the higher pressure of the centrifugal fan. Radial propellers produce a static pressure increase because of the centrifugal force acting in a radial direction. There is no equivalent pressure increase with axial impellers because the airflow is normally axial. Mixed-flow fan is suitable for roof mounting where the direction of airflow through the fan cannot be reversed.

4. **Axial-flow Fan:** An axial flow fan is generally smaller than a centrifugal fan and more efficient than propeller fan for the same output because of the aerofoil section blades and finer clearances between the impeller blade tips and the cylindrical fan casing. However, an axial-flow fan has limited application with hot or moist fumes.

In terms of fan application, three out of six main applications – industrial boiler, high pressure and general application - make up 97% of the industrial market, as shown in figure 8. Other applications include general axial-flow, power plant matching, and dust discharge.



Source: Fan Manufactories Catalog 2001

Market Size

Pumps

In 2000, 1,029,747 units were produced in China. Of this, 899,619 units were centrifugal pumps, accounting for 87.4%, used mainly for pumping water rather than production process application. Centrifugal pumps that are used in process application normally require higher quality material than water pumping application due to their main function to transfer chemical substances. The overall sales revenue of pumps was US$537.12 million. Model QY25-26-3 has the largest market share, accounting for 20% of the total pump market. The top ten manufacturers had 32% of the total market share, or US$170.55 million.

Fans

As mentioned in section 2.1.2, the centrifugal fan is the most commonly used in the industrial market. The national sales revenue of fans was US$364 million. The top ten manufacturers controlled 69% of the market, or US$ 251 million. There are 481 different fan types covering more than 5,000 models in China. One of the best selling models is 4-72 No.5, which is estimated to control between 25-50% of the total fan market.

Export and Import

Export

Vicious competition from low cost manufacturers has had a negative impact on original equipment manufacturers (OEMs) and the whole market. While many OEMs have made capital investments into advanced technology, low cost manufacturers have simply copied OEM products. By manufacturing them using cheaper materials and processes, these manufacturers are able to offer lower cost models, which generally perform much lower efficiency. For their part, consumers have traditionally not paid much attention to energy efficiency when purchasing and using pumps and fans, which indicates that price remains the most important decision-making factor. The most important export market is developing countries, particularly South East Asia region. However, the export sales revenue from top ten and top eleven pump and fan manufactures in 2001 were US$44.62 and US$17.12 million, respectively. This represents about 25% and 28%, respectively; of the total export markets for each category, which indicates that this could be a significant growth area.

Import

Detailed information and statistics on imports are not readily available. What is known is that total import revenue for pumps and fans are US$ 364.8 million and US$ 147.7 million, respectively. Thus, imports are roughly double exports. Imports tend to emphasize large and specialized pumps and fans which have a high value.

Efficiency Level

Continuous technology development has led to a progressive increase of pump and fan efficiency. Efficiency is calculated by measuring losses during test procedures. The efficiency can be illustrated by the following equation. It must be noted that the losses are the sum of the individual losses produced in the equipment

Efficiency = output/input
= 1-(losses/input)

The common way to increase efficiency level is to reduce losses, but losses cannot be eliminated entirely. This section discusses basic knowledge of losses in pump and fan including the efficiency levels of products sold in China.

Because of the familiarity in working theory and inert structure, there are common losses of pump and fan, mechanical, volume, and hydrodynamic/aerodynamic losses (table 1).

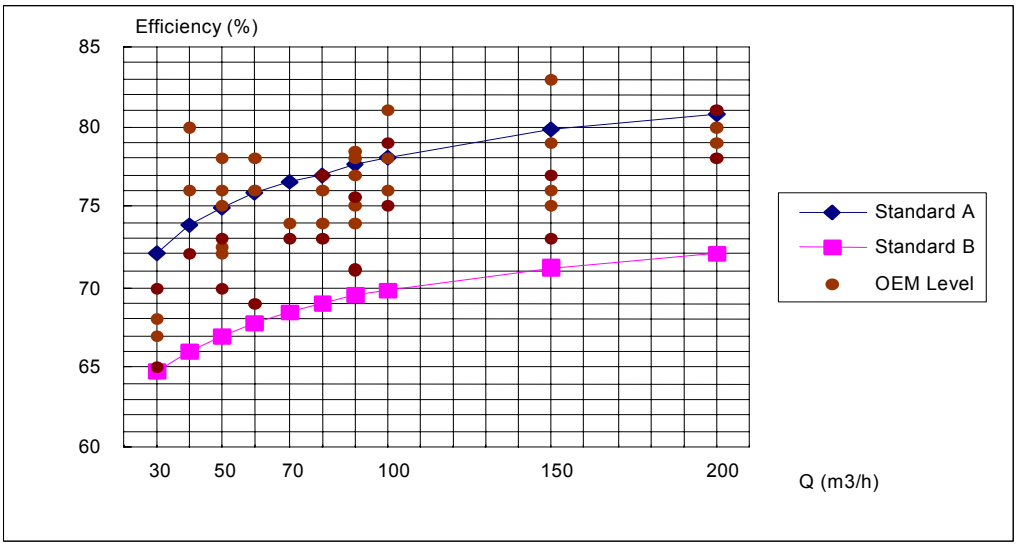
Table 1: Losses in Pumps and Fans – Information Summary

Loss	Pump	Fan
1. Mechanical Loss	We define the loss produced by friction of bearing and impeller as Mechanical loss. The former is more important, sometimes it represents 30 percent of effective power. To reduce the mechanical loss, there are normally two ways. Firstly, avoid increasing pump head by enlarging the diameter of the impeller because mechanical loss is in direct ratio with the diameter's square. Secondly, reduce friction coefficient by doing surface treatment, which can effectively increase mechanical efficiency about 2-5%.	1. Skin friction losses relate directly to the formation and growth of boundary layers on impeller surfaces. 2. Friction losses are due principally to flow separation from negative pressure blade faces, formation of eddies within fan-entrained fluid volume, and turbulent mixing within the through flow.
2. Volumetric Efficiency	Generally speaking, the larger the specific speed value means the higher volume efficiency. Volumetric efficiency typically improves as the clearance of the sealing gaps decreases.	Clearance losses are incurred by leakage of air between inlet and impeller. Power losses are due to the re-entry of discharged fluid back through this running clearance; pressure and volume flow losses may be caused by an interaction between recalculating flow and mainstream inlet flow.
3. Hydrodynamic / Aerodynamic Loss	Hydrodynamic loss is affected by shape of the pump impeller, roughness of pump body, and fluid viscosity. Losses are mainly generated at the impeller andthe guide vane. Thus, surface treatment of those parts can increase efficiency 2-3%. In addition, attention to the design of the flow channel can improve efficiency such as changing speed gently, avoiding backwater, avoiding acute angle and other odd shapes, and increasing degree of finish.	Aerodynamic loss consists of: Entry losses are incurred in changing the predominant airflow direction from axial to radial. the degree of loss is sensitive to inlet design and shroud lip curvature. Impeller inlet losses are caused by a mis-match between the blade angle and relative flow angle. Sensitivity to blade inlet angle can also lead to a substantial reduction in through flow, if a stall zone blocks inlet and diverts substantially radial flow velocities Diffusion losses, known as kinetic energy of the discharged air, must be efficiently converted to static energy within the volute. Pressure losses are caused by flow separation inside casing. A volute shape is only optimum at one flow rate and for fully turbulent flow conditions.

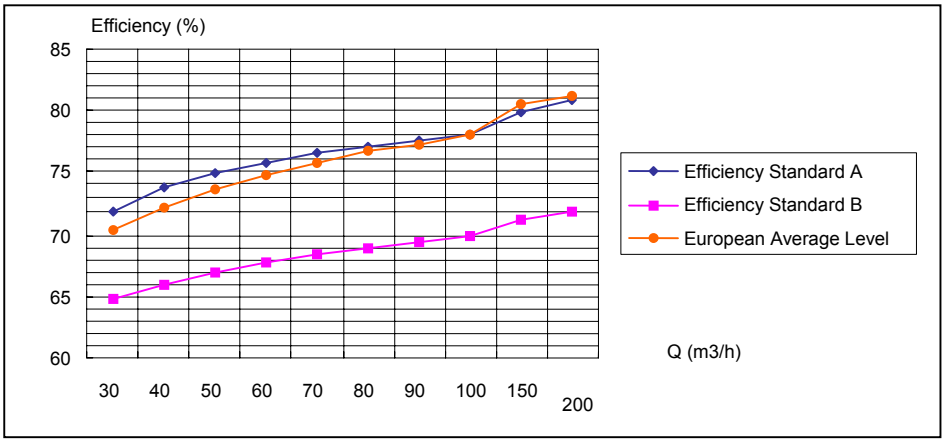
Pumps

Figure 9 illustrates efficiency of the OEMs' best selling application, the single-stage single-suction clean water pump, compared to national standard and average European efficiency level. At the same flow rate, it is clearly seen that the efficiency of the OEM products are higher than the national standard B, but less than 30% of them can achieve standard A. Because of very close efficiency level between standard A and average European level, this means that almost all OEM products still perform at lower efficiencies than equivalent European products.

Figure 9: Efficiency of OEM Product Compared to National and European Standard.



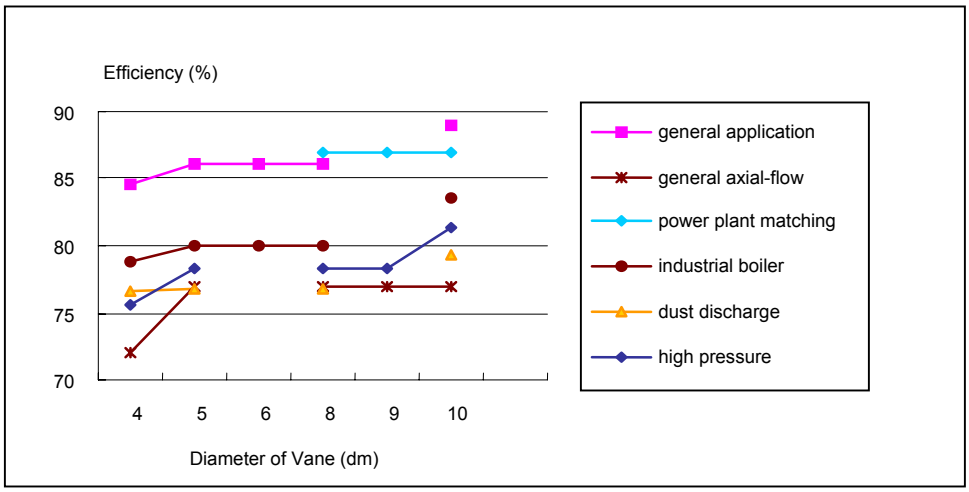
Source: Energy Efficiency Improvement in Electric Motors and Drives, National/Industrial Standards Compilation (Pump Special) 1998.



Fans

Figure 10 shows efficiency levels for five main applications of centrifugal fans, the largest selling fan sector by volume, and general axial-flow fan, the second largest sales volume in China's market.

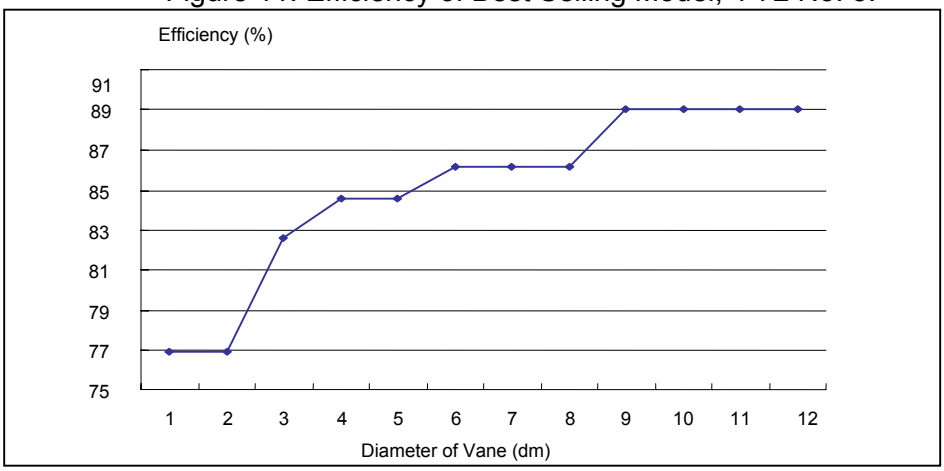
Figure 10: Efficiency of Five Main Applications of Centrifugal Fan, Including Axial-flow Fans.



Source: National/Industrial Standards Compilation (Pump Special) 1998,

As mentioned earlier, model 4-72 No. 5 is the best selling model among the more than 5000 models available in the Chinese market. Thus, it is worthwhile to illustrate efficiency level of model 4-72 No.5 as shown in figure 11. Actually, it may be widely used in various applications mentioned in figure 11, for example, a small 4-72 No.5 model can be used in industrial boiler or dust discharge.

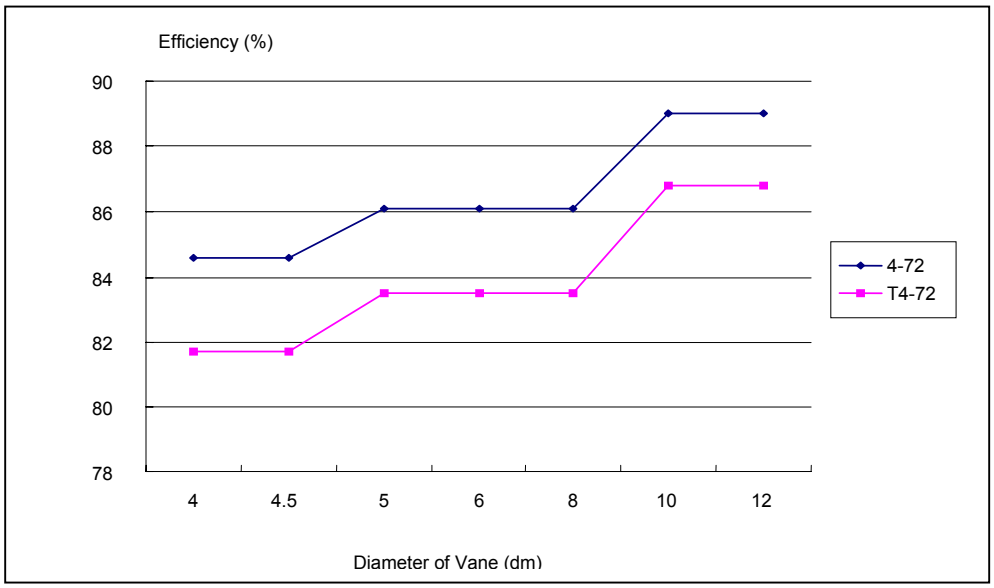
Figure 11: Efficiency of Best Selling Model, 4-72 No. 5.



Source: Product Catalog of Pump- Shenyang Pump Research Institute 1994

In addition, different vane structure translates into different efficiency level as shown in figure 13. Model 4-72 No. 5 has a vane with airfoil structure while model T4-72 has a flatter shape. At the same vane diameter, airfoil structure of model 4-72 performs higher efficiency than flat vane structure of model T4-72 as shown in figure 12.

Figure 12: Efficiency of Different Vane Structure of Model 4-72 and T4-72.



Source: Fan Manufactories Catalog 2001

Testing Methodology and Standard

Pumps

The testing methodologies of pumps in China that contribute to the national standard can be summarized below;

Table 2: Testing Methodologies of Pumps.

Reference Code	Description	Authority
GB/T 13007-91	Efficiency for Centrifugal Pumps	Testing and Quarantine of the People's Republic of China
JB/T 8092-96	Small Submersible Motor Pumps	Previous Mechanical Industrial Department
CCEC/T ***-2001	Centrifugal Energy Saving Product Identification Technology Requirement	China National Institute of Standardization (under revision)

Fans

Unlike pumps, there is no special standard for fan efficiency. Testing of efficiency is implemented by calculation of relative parameters. Standards prescribe that the variation between testing value and the alleged efficiency should be no more than 5%.

All requirements for testing are listed and limited by national standards, which determine the level of precision. So from a theoretical perspective, all the testing data have equal validity. But the truth is some small manufactories often do not carry out the rigorous testing under the terms of the national standards. Two thirds of all manufacturers do not

have independent testing equipment at all. These conditions mean that low efficiency products often enter the market regardless of the national standards.

Testing method standards for fans are illustrated below:

- GB/T 1236-2000 industrial fan, Implement performance testing by standard wind channel. Adopted from ISO 5801-1997 (laboratory tested).
- GB10178-88:Site testing of fans.. Equal to ISO/DIP 5802 (on site tested).

In addition, usage of in-house developed software has increased in testing methodology in China, for example:

- FAN 3.0: Calculate data from testing and draw the performance curve, designed by Shenyang Blower Research Institute
- MGS: Utilize sensor and electrical signal to collect and process data, designed by Xi'an Jiaotong University (in test run)
- MCGS2.0: Collect, process-testing data, flash display, and print table, designed by Beijing Zhongtai Computer Technology Research Institute.

In terms of number of fans being tested in recent three years, centrifugal fans have been tested in higher proportion than other types of fan, as shown in table 3.

Table 3: Number of Fans Being Tested by Shenyang Blower Research Institute 1999-2001.

Year / Type of fan	Centrifugal Fan	Axial-flow Fan	Total
1999	15	8	23
2000	16	5	21
2001	27	4	31
Total	58	17	75

Source: Shenyang Blower Research Institute 2001.

Manufacturer Data

All pump and fan manufacturers in China can be divided into four levels: high class, middle class 1, middle class 2 and low class as bellow;

Table 4: Classification of Pump and Fan OEM.

Classification	Pump	Fan	Total
High Class	25	12	37
Middle Class 1	479	153	632
Middle Class 2	2,882	1,142	4,042
Low Class	>1,700	>3,700	>5,400
Total	>5,000	>5,000	>10,000

Source: Pump Manufactories Catalog 1999, Fan Manufactories Catalog 2001.

High Class:
The manufacturers categorized in this class always play a major role in the market. Their products' quality is usually more efficient than products from manufacturers in the other categories.

Middle Class1:
The majority of pump and fan association members are categorized in this class (many lower class manufacturers are not in the Association). Sales revenue of products produced by Middle Class1 manufacturers is less than the High Class but the quality and efficiency of products is almost the same as that of the High Class manufacturers.

Middle Class 2:
The Middle Class 2 is the largest group of pump and fan manufacturers in China. Most of them are smaller enterprises with little capital for expansion. They do not provide a high level of technological specialization and efficiency. Most of them do not have special testing devices so they do not undertake routine testing at all.

Low Class:
Low Class manufacturers have few employees, generally family members. They typically lack both testing device and necessary mould (die) for formal manufacturing processes. The quality and efficiency of products are very low, as is their price. Many of these products are sold to local agriculture or electrical/mechanical companies, usually in open-air markets, located in peri-urban or rural areas. The majority of buyers are rural agricultural workers.

Pumps

According to the statistics provided by the pump associations in year 2000, the top 10 manufacturers, out of 234 members, account for 37.9% of total sales revenue, as shown in table 5.

Table 5: Sales Revenue of Top Ten Pump Manufacturers.

Name	Million RMB	Million US$	Share (%)
Zhejiang Fengqiu (Group) Co., Ltd.	259.08	31.44	5.9
Shandong Shuanglun (Group) Co.,Ltd.	178.74	21.69	4.0
Changsha Tongsa (Group) Co., Ltd.	175.48	21.30	4.0
Tianjin Pump (Group) Co., Ltd.	169.41	20.59	3.8
Dalian Acid-Proof Pump Works	165.44	20.08	3.7
Boshan Pump (Group) Co., Ltd.	163.55	19.85	3.7
Shenyang Pump (Group) Co., Ltd.	151.82	18.42	3.4
Shanghai KSB Pump Co., Ltd.	141.85	17.21	3.2
Foshan Pump Works	136.59	16.58	3.1
Shijiazhuang Pump (Group) Co.,Ltd.	135.24	16.41	3.1
Total Sales Revenue of 10 Manufacturers	1,677.20	203.57	37.9
Total National Sales Revenue	4,425.89	537.12	100

Source: China Machinery Industrial Yearbook 2000.

Export and Import

Leading OEMs are still key exporters, having developed the capacity and competitive strategies needed to compete in the global marketplace. Table 6 shows the top ten pump exporters. In 2000, the overall export sales revenue of pumps from these manufacturers was US$44.62 million, the total export volume was $178 million, while the total import volume was US$364.7 million. Clearly there is a great deal of room for improvement in this balance.

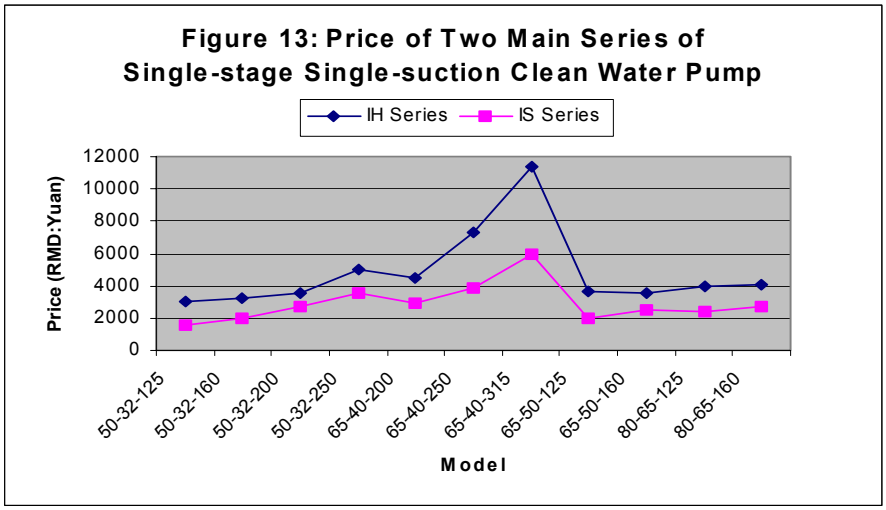
Table 6: Sales Revenue of Top Ten Pump Exporters.

Name	Million RMB	Million US$	Share (%)
Zhejiang Fengqiu (Group) Co., Ltd.	100.77	12.23	6.87
Boshan Pump (Group) Co., Ltd.	87.38	10.60	5.96
Shanghai KSB Pump Co., Ltd.	33.77	4.10	2.30
Shandong Yalong Pump (Group) Co., Ltd.	31.25	3.79	2.13
Foshan Pump Works	27.24	3.31	1.86
Anhui Sanlian Pump (Group) Co., Ltd.	20.87	2.53	1.42
Anhui Laien Pump (Group) Co., Ltd.	18.80	2.28	1.28
Wuxi Pump Works	17.74	2.15	1.21
Shandong Shuanglun (Group) Co.,Ltd.	16.88	2.05	1.15
Nanjing Guerz Co.,Ltd.	13.00	1.58	0.89
Total Export Sales Revenue	367.70	44.62	25.06
Total Export Sales Revenue of all pump exporters)	1,467.22	178.06	100.00

Source: China General Machinery Industrial Yearbook 2000.

Price

Single-stage single-suction clean water pump is the main application in the market. Figure 13 illustrates the price of two main series, IH and IS, sold in the Chinese market. IH series are typically different from IS series in terms of their enclosure and detailed application, rather than their efficiency. The first, second, and third part of the model name are size of suction, discharge, and vane diameter respectively.



Source: Chinese Mechanical and Electrical Product Price List-Pump Volume 2001.

Fans

In the fan associations, there are 12 key members of the total 129 members, accounting for 69.1% of total sales, as shown in table 7.

Table 7: Sales Revenue of Top Ten Fan Manufacturers.

Name	Million RMB	Million US$	Share (%)
Zhejiang Shangfeng Group	860	104	28.7
Shenyang Blower Works	325	39	10.8
Shanxi Blower (Group) Co., Ltd.	322	39	10.7
Shanghai Blower Works Co., Ltd.	165	20	5.5
Shandong Huifeng Machine Group	124	15	4.1
Chongqing General Industry (Group) Co., Ltd.	70	9	2.3
Changsha Blower Works	65	8	2.2
Changshu Blower Works	63	8	2.1
Jilin Blower Works	43	5	1.4
Wuhan Blower Works	32	4	1.1
Total Sales Revenue of 12 Manufacturers	2,069	251	69.1
Total National Sales Revenue	2,996	364	100.00

Source: China General Machinery Industry Yearbook 2000

Export and Import

Unlike pump exporters, only one leading fan OEM, Zhejiang Shangfeng Group, is a major fan exporter, accounting for 15% of export sales revenue. The second largest fan exporter is Shanghai Blower Works Co., Ltd., which generated only 8% of export sales revenue. Table 8 illustrates the top eleven fan exporters. The overall export sales revenue of fans was US$60.16 million while the total import volume was US$147.7 million.

Table 8: Sales Revenue of Top Eleven Fan Exporters.

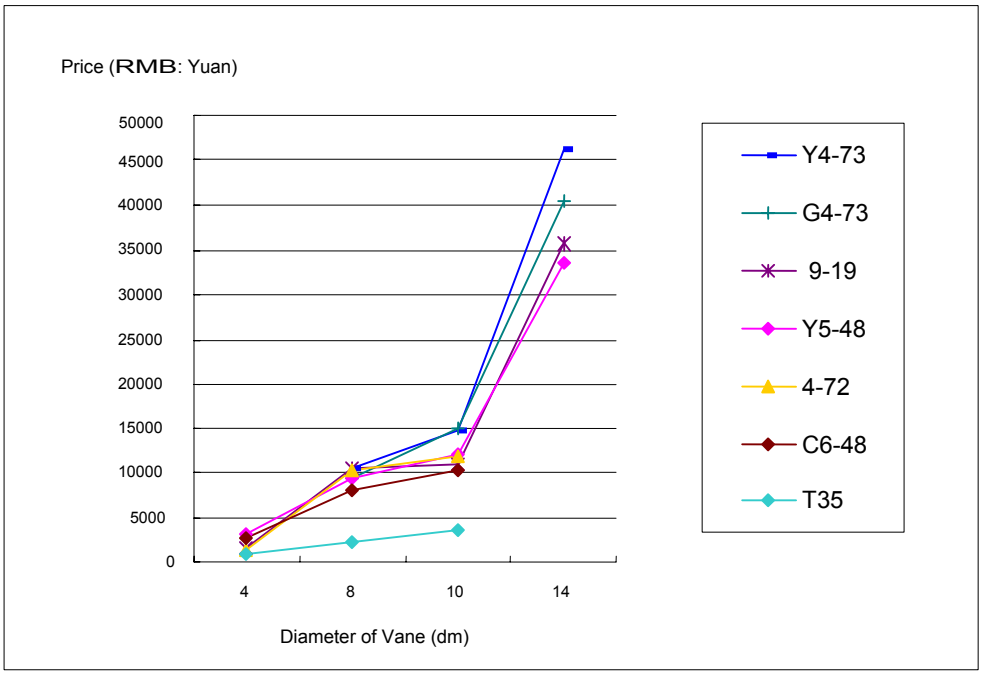
Name	Million RMB	Million US$	Share (%)
Zhejiang Shangfeng Group	72.96	8.85	14.72
Shanghai Blower Works Co., Ltd.	37.48	4.55	7.56
Shenyang Blower Works	7.08	0.86	1.43
Wuhan Blower Works	6.66	0.81	1.34
Shanxi Blower (Group) Co., Ltd.	4.22	0.51	0.85
Yixing Huaxing Special Fan Works	3.92	0.48	0.79
Shandong Dezhou Glass-steer Works	2.60	0.32	0.52
Changshu Blower Works	2.10	0.25	0.42
Tianjin Blower Works	1.49	0.18	0.30
Qingdao Fan Works	1.27	0.15	0.26
Chongqing General Industry (Group) Co., Ltd.	1.26	0.15	0.25
Total	141.04	17.11	28.45
Total Export Sales Revenue of all fan exporters	495.68	60.16	100.00

Source: China General Machinery Industrial Yearbook 2000.

Price

The fan prices depend, generally, on the vane diameter. Further, because fan efficiency is not an important decision factor for consumers, manufacturers still compete intensely based on price. Product efficiency only factors to a limited extent in manufacturers' competitive strategies Figure 14 illustrates price of various popular models, by vane diameter, sold in China. Price of 14- dm diameter is much more expensive than price of 4-, 8-, 10-dm diameter of the same model.

Figure 14: Price of Various Popular Fan Models



Source: Chinese Mechanical and Electrical Product Price List-ventilator Volume 2000.

THE MARKET

Before going further into the analysis of the pump and fan market in China, the end user perspective has to be taken into account. The majority of end users of both pumps and fans are rural agricultural workers for whom price is the most important decision factor in purchasing a pump or fan. Energy efficiency is not yet a critical factor in purchasing decisions. The lower class products, which normally offer lower prices and efficiency, seem to be profitable. The situation has forced large manufacturers to reconsider their business strategy. As a result, some of them have shifted their marketing focus from the domestic to the international market. Compared to exporters from other countries, large Chinese manufacturers have competitive advantages in terms of their vast economies of scale, cheap labor and land, and China's rapidly improving quality of skilled labor and infrastructure. These factors allow them to offer products as efficient as international producers but at a lower price. Thus, high quality and efficient products enjoy a better position in the high-end export markets than in the domestic market. Similarly, low cost manufacturers, producing low to medium quality products for the China market, also find great opportunities to penetrate the markets of other developing countries, particularly in South East Asia. Those countries also produce low to medium quality products but their production costs are still more expensive than for Chinese products. This has created intense competition between Chinese and Asian producers in this market niche.

After more than 15 years of applying, China received full WTO membership in December 2001. China's membership will provide both positive and negative impacts on its own economy and that of the rest of the world. Each industry will be affected differently. Due to its enormous size, China is expected to be one of the biggest markets in the 21st century and should continue to attract significant amounts of foreign investment.

Foreign firms will enter China market and enjoy wider investment opportunities, cheaper factors of production, lowering tariffs and standardizing non-tariff measures. On the other hand, China will enter the world market as low cost producer, although it may encounter non-tariff barriers such as human rights and environmental issues.

Unavoidably, pump and fan industry would have impact in several ways as follows;

1. Product Quality

As noted, the majority of end users have traditionally been rural agricultural workers, who have not valued the benefits of high-energy efficiency products. Low to medium quality products, therefore, dominate the market. After China's accession into WTO, foreign-funded manufacturers may take advantage of the opportunity to take over and/or enter into joint ventures with Chinese manufacturers. As a result, advanced technology developments, management philosophies, and overall expertise will transfer to China. Product quality will increase while production costs are reduced. If the price of standard products can be reduced to same price as low quality products manufactured by low class manufacturers, lower quality producers will have to improve product quality and efficiency, reduce costs further (to remain the low cost provider) or be driven out of the market.

However, even a reduction in the costs of the higher quality products may still not increase their market share in China without some support and promotion from government, unless these products can compete on price terms with the lower cost products favored by the rural agricultural workers. As a result, high quality products may mainly be exported to world markets.

2. Product Cost

Cost of medium to high efficiency products, including specific application products, will decrease as manufacturing plants are moved from other countries to China. China manufactured products will enter and compete advantageously in the world market. Imported products will face increased competition from locally manufactured products in the Chinese market. In addition, competition is likely to intensify in other developing countries, particularly within Asia, as China continues to maintain low production costs, while increasing product quality.

3. Import and Export Market

As tariff barriers are lowered and standards are established in China, foreign manufacturers will gain confidence in the investment environment. While the price of imported products will decrease, they may not be able to compete with locally made products. To compete in China's market, foreign manufacturers tend to locate their production in China in order to lower the costs of production and marketing. Some imported products will be highly sophisticated or have highly specialized niche applications and will therefore not support relocation of production in China. Products made in China by Chinese and foreign companies, on the other hand, will penetrate into the world market. Foreign manufacturers will be able to introduce their high quality, low cost, Chinese made products under their recognized brand names to the international market which will further drive total Chinese export volumes.

4. Opportunity of High Efficiency Product

As part of the research, for this report, a survey was conducted at the market in Hangzhou, which houses 26 pump sales agents and 4 fan sales agents. Not surprisingly, five of the pump salesmen and two of the fan salesmen are not familiar with the concept of energy efficiency. More importantly, twenty pump salesmen and two of the fan salesmen said buyers do not care about the efficiency of the product. In a similar survey of buyers, most do not know what efficiency is. Only one agent said buyers in mechanical sectors sometimes care about efficiency criteria.

In terms of current energy saving efforts, the Chinese Mechanical Industry Energy Saving Center has been working to promote pump and fan efficiency for more than 20 years. They have identified the following pump and fan series as energy saving products, publicizing and encouraging their use in the marketplace.

Pump;

IS Single-stage Single Suction clean water series
IB65-50-160/IB80-65-160 Single-stage Single Suction clean water series
IT Single-stage Single Suction clean water series
XA series Single-state centrifugal pump

Fan;

9-19 series
9-26 series
C6-48 series Y5-48 series fan
Y8-39, Y9-38 series
T/BT35 axial-flow fan
AL series centrifugal fan
GY6-41 series (95 type) boiler fan
GG/GY35 boiler fan
GG/GY50 boiler fan
GG/GY75 boiler fan
AS/MS series centrifugal fan (C type drive)

However, one of the most significant factors that is necessary for high efficiency product opportunity is government support and promotion. This includes:

1. Building energy conservation awareness

To achieve sustainable energy conservation, public awareness is probably the most important fundamental factor. Professional public relations campaigns have to be strategically formulated in order to attack target market sectors. These markets have to be further understood and prioritized. Training and education on energy efficiency and management has to be embedded in national policy. Other supportive media have to be organized into sources of useful information, such as an energy efficiency product and technology clearinghouse on the Internet.

2. Organizing financial support

Financial support seems to be an essential mechanism in encouraging both the end user and manufacturer to use and produce high efficiency product. And financial support mechanisms may need to address each side of the market equation – supply and demand.

On the demand side, the price of energy efficient products is the most important factor. At the initial stage of the program, financial support may be provided in the form of a rebate program. Loan programs targeted at end users may not be effective because, firstly, the initial cost is still higher than existing product and, secondly, there are rules and regulations so that end users may be unwilling to accept the government's complicated and time-consuming evaluation and verification procedure of both applicant qualification, and the energy saving outcome would be an obstacle for the financial support program. Even though the energy savings and performance improvements may pay for the higher price over time, there is still a psychological barrier of higher initial price and the insecurity of the banking system.

On the manufacturing side, financial support aims to mitigate the cost of production and marketing new high efficiency products. Interest free or low interest loans for newly installed machine and equipment needed for production is one option. In addition, technical support from government should be integrated into the financial package in order to assure the optimum outcome. Another option is to support the marketing activities of energy efficient products. This may come in form of, for example, an advertisement subsidy program or support of a branding activity.

Others major policies have already been executed in China such as the 1998 Energy Conservation Law of the People's Republic of China, and the standard and labeling rules governing motor efficiency. As the motor is one of the main electricity consumers in all sectors, promotion of high efficiency motor design can significantly reduce energy consumption. Because pumps and fans are the biggest application for motors, standard and labeling for pump and fan efficiency is another helpful policy in encouraging end user purchase and utilization of these products.

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